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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/765,521	01/18/2001	Mark A. Lemkin	IMIN-01008US1	9535

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EXAMINER	
BELLAMY, TAMIKO D	
ART UNIT	PAPER NUMBER
2856	

DATE MAILED: 02/12/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/765,521	LEMKIN ET AL.
	Examiner	Art Unit
	Tamiko D. Bellamy	2856

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 09 December 2002 .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-25 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-25 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claim 1-6, 8-12, 17-25 is rejected under 35 U.S.C. 102(e) as being anticipated by Chu et al. (6,301,965).

With respect to claims 1, and 2,Chu et al. discloses in Figs. 3 and 6 sensitivity of the MEM accelerometer 10 is increased by ganging the various electrodes 30, 32, and 36 (col. 8, lines 45- 47), an amplifier 18 is connected to stationary electrodes 30 and 32 via a pair of digital transistor switched 44; the feedback signal can be applied to electrodes 30 and 32 through another pair of digital switches 54 (col. 9, lines 43-51), a digital feedback control circuit 14 (col. 5, line 56), and a pair of oppositely connected single-proof-mass (col. 13, lines 50-64). The use of the amplifier 18 is inherently a differential charge integrator as claimed.

With respect to claim 3, Chu et al. discloses in Figs. 1, 2C and 2D, and 6 a series of timing diagrams for operating the single-proof-mass MEM accelerometer (col. 5, line 19), the amplifier 18 senses the capacitively generated from the stationary electrodes 30 and 32 (col. 8, lines 61-63), and a first sensing time interval and a second sensing time

interval (col. 9, lines 1-5). As shown in Figs. 2C and 2D, the amplifier 18 is inherent to senses/operates over a non-overlapping time period as claimed.

With respect to claims 4 and 6, Chu et al. discloses in Fig. 3, the transistor switches are provided in parallel with feedback capacitors (col. 9, line34-35), and the feedback signal can be applied to the electrodes 30, 32 through digital switches 54 (col. 9, lines 47-59). As shown in Fig.3, the feedback capacitors are within a feedback loop, which is inherently a common mode feedback. With further limitations of claim 6, Chu et al. discloses transistor switches are in parallel with the feedback capacitors in each gain stage to reset the gain to zero at the end of each sensing time interval (col. 9, lines 34-37).

With respect to claim 5, Chu et al. discloses an input common-mode amplifier (col. 9, line 16).

With respect to claim 8, Chu et al. discloses by sensing the change in capacitance with the digital feedback control circuit 14, the position of the proof mass 34 can be determined over a period of time to measure acceleration (col. 8, line 42-45), the digital feedback control circuit 14 operates at a clock frequency 4MHz, and the clock frequency can be selected to be in the range of 1-100 MHz (col. 10, lines 37-43).

With respect to claim 9, Chu et al. discloses the amplifier 18 senses the capacitively generated from the stationary electrodes 30 and 32; and the proof mass 34 which is connected to the movable electrodes 36 (col. 8, lines 61-66).

With respect to claims 10 and 23, Chu et al. discloses in Figs. 1 and 6 a plurality of substrates 16 with the individual accelerometers (col. 8, lines 31-35), the sensing activity of the accelerometer 10 is increased by ganging the various electrodes 30, 32, and

36 (col. 8, lines 45-47), a pair of oppositely connected single-proof-mass and a substrate 16 (col. 13, lines 50-55).

With respect to claim 11, Chu et al. discloses in Fig. 5a multi-level comparator 22 can be used to route a fixed value of the feedback voltage to different combinations of stationary electrodes 30 or 32 to provide different levels of electrostatic force to urge the proof mass 34 back towards it initial position (col. 13, lines 23-28), and the filtered signal can be used to drive a comparator 22 to generate one of three states (col. 14, lines 30-36).

With respect to claim 12, Chu et al. discloses the sensing activity of the accelerometer 10 is increased by ganging the various electrodes 30, 32, and 36 (col. 8, lines 45-47), a pair of oppositely connected single-proof-mass and a substrate 16 (col. 13, lines 50-55).

With respect to claims 17-20, Chu et al. discloses in Fig. 3 and 6 a MEM accelerometer structure 70, the two structures can be located in a common cavity 24 etched into a substrate 16 (col. 13, lines 54-54), the digital feedback control circuit 14 is fabricated on the same substrate16 as the MEM accelerometer structures 23 and 70 (col. 14, lines 51-54), a amplifier 18, and the digital feedback control circuit 14 comprises a negative feedback loop (col. 7, lines 32-34). With respect to further limitations of claim 18, Chu et al discloses the amplifier 18 senses a capacitively generated electrical signal from the stationary electrodes 30 and 32 (col. 8, lines 61-63), the amplified signal is filtered by filter 20 (col. 14, lines 19-20), and the and the filtered signal can be used to drive a comparator 22 for providing feedback to electrically control the position of each proof mass 34 (col. 14, lines 30-36). With respect to further limitations of claim 19, Chu

et al discloses the MEM accelerometer is formed from a pair of oppositely pair of oppositely connected single-proof-mass MEM accelerometer structures 12 as described with reference to Fig. 1 (col. 13, lines 50-54). With respect to further limitations of claim 20, Chu et al. discloses electrodes located on the substrate proximate to each proof mass to capacitively generate an electrical signal indicative of acceleration of the proof mass (col. 3, lines 48-56).

With respect to claim 21, Chu et al. discloses in Fig. 6 the digital feedback control circuit 14 comprises an amplifier 18, a filter 20, and a comparator 22 (col. 8, lines 53-55), and the proof masses 34 are coupled into the amplifier 18 (col. 14, lines 15-16).

With respect to claim 22, Chu et al. discloses in Figs. 3 and 6 the sensitivity of the MEM accelerometer 10 is increased by ganging the various electrodes 30, 32, and 36 (col. 8, lines 45- 47).

With respect to claim 24, Chu et al. discloses digital switches 44 are closes to connect the stationary electrodes 30 and 32 of each MEM accelerometer structure 12 to the amplifier except during the force feedback time interval (col. 14, lines 4-9).

With respect to claim 25, Chu et al. discloses during the SEN2 (second gain stage (col. 9, line 40)) time interval the amplified electrical signal is filtered by the filter 20 to remove at the resonance-frequency components of the electrical signal produced by the mechanical resonance of each of the proof masses 34 are then integrated (col. 14, lines 18-22).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (6,301,965) in view of Lemkin et al. (6,386,032).

With respect to claim 7, Chu et al. does not specifically disclose the feedback is frequency multiplexed. However, Lemkin et al. discloses frequency domain multiplexing of capacitor function, may be formed by using different-valued modulation frequencies (col. 6, lines 34-36). It would have been obvious at the time the invention the invention was made to a person having ordinary skill in the art to use Chu et al. according to the teachings of Lemkin et al. to provide a feedback that is frequency multiplexed as the system of Chu et al. would operate equally well on either tested structure. Evidence of the can be found in Chu et al. which discloses a notch filter 20 can be implemented as a continuous-time filter or as a digital notch filter (col. 9, lines 65-67), the filtered signal can then be used to drive a comparator 22 to generate one of three states for providing feedback to electrostatically control the position of each proof mass 34 (col. 14, lines 30-36), and the digital feedback control circuit 14 operates at a clock frequency 4MHz, and the clock frequency can be selected to be in the range of 1-100 MHz (col. 10, lines 37-43).

5. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (6,301,965) in view of Lee et al. (6,230, 566).

With respect to claims 13 and 14, Chu et al lacks the detail of a position sense interface with a reference capacitor. However, Chu et al. discloses in Figs. 1 and 6 a digital feedback control circuit 14 (col. 5, line 56), which is equivalent to a position sense interface; a pair of oppositely connected single-proof-masses (col. 13, lines 50-64); and sensitivity of the MEM accelerometer 10 is increased by ganging the various electrodes 30, 32, and 36 (col. 8, lines 45- 47). Furthermore, Lee et al. discloses in Figs. 7 and 8 double accelerometers, proof masses 121 and 122, a pair of plate type sense capacitors 127 and 128; a pair of reference capacitors 133 and 134, having electrodes 96-97, in the substrate 84 (col. 7, lines 12-37). It would have been obvious at the time the invention the invention was made to a person having ordinary skill in the art to use Chu et al. according to the teachings of Lee et al. to provide a position sense interface with a reference capacitor as the system of Chu et al. would operate equally well on either tested structure. Evidence of the can be found in Chu et al. which discloses a pair of oppositely connected single-proof-mass and a substrate 16 (col. 13, lines 50-55).

With respect to claim 15, Chu et al. lacks the detail of a position sense interface including at least one binary weighted capacitor in parallel with at least one reference capacitor. However, Chu et al. discloses the amplifier 18 includes an offset trim for each input (col. 9, lines 19-20). It is well know in the art to use binary weighted capacitors

(col. 7, lines 12-37). It would have been obvious at the time the invention the invention was made to a person having ordinary skill in the art to use Chu et al. according to the teachings of Lee et al. to include at least one binary weighted capacitor in parallel with at least one reference capacitor as the system of Chu et al. would operate equally well on either tested structure. Evidence of the can be found in Chu et al. which discloses the amplifier 18 includes an offset trim for each input (col. 9, lines 19-20).

With respect to claim 16 , Chu et al. lacks the detail of a charge applied to the position detection circuitry by changing voltage applied to the reference capacitors. Lee et al. discloses in Figs. 7 and 8 double accelerometers, proof masses 121 and 122, a pair of plate type sense capacitors 127 and 128; a pair of reference capacitors 133 and 134, having electrodes 96-97, in the substrate 84 (col. 7, lines 12-37). It would have been obvious at the time the invention the invention was made to a person having ordinary skill in the art to use Chu et al. according to the teachings of Lee et al. to provide a charge applied to the position detection circuitry by changing voltage applied to the reference capacitor as the system of Chu et al. would operate equally well on either tested structure. Evidence of the can be found in Chu et al. which discloses a pair of oppositely connected single-proof-mass and a substrate 16 (col. 13, lines 50-55); and a voltage change, provided to the proof mass 34 induces a current signal on to the stationary fingers 30 and 32 which is detected by the amplifier 18 (col. 9, lines 11-14).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

7. The following patents are cited to further show the state of the art with respect to detection circuits for a capacitive sensor.

U.S. Pat. No. (5,661, 240) to Kemp

U.S. Pat. No. (5,343,766) to Lee

U.S. Pat. No. (5,986,497) to Tsugai

U.S. Pat. No. (5,612,494) to Shibanano

U.S. Pat. No. (5,281, 860) to Krenik et al.

U.S. Pat. No. (4,633,223) to Senderowicz

8. The following patents are cited to further show the state of the art with respect decoupled sense capacitors.

U.S. Pat. No. (6,055,858) to Muenzel et al.

U.S. Pat. No. (6,291,875) to Clark et al.

U.S. Pat. No. (6,230,563) to Clark et al.

U.S. Pat. No. (6,253, 621) to Lemkin et al.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tamiko D. Bellamy whose telephone number is (703) 305-4971. The examiner can normally be reached on Monday through Friday 8:30 AM to 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron Williams can be reached on (703) 305-4705. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-1782.

Tamiko Bellamy
T. B.
February 3, 2003

HELEN KWOK
PRIMARY EXAMINER
Helen Kwok